Much of the vector notion was learned in 1st year physics, including breaking vectors in to components, called vector decomposition.

Adding (or subtracting if negative) the vectors in each direction will allow you to find a single resultant from all the components. This is vector resolution.

The main difference this year is that at times we'll use the cartesian coordinate system (instead of the polar North, South, East & West).

Also, this year we'll use UNIT VECTORS, which are more universal than other forms.

By definition $\hat{i}$ = (1, positive x-direction)
$\hat{j}$ = (1, positive y-direction)
$\hat{k}$ = (1, positive z-direction)

We can use unit vectors to add all the x-components to give the x-component of the resultant; and do the same with all the y-components.

* Be careful to remember that components going in a negative direction will likely need a negative sign manually inserted when performing vector decomposition.

At times, such as on a hill/incline plane, it's useful tilt the axes of the coordinate system. Unit vectors work great in this situation, since the axes are simple parallel and perpendicular to each other, <u>not</u> necessarily horizontal or vertical with respect to the earth.

## Sample Problems

Problem 20, end of book: → The key term is "magnitude"

$\vec{E} = 2i + 3j$ $\qquad \vec{F} = 2\hat{i} - 2\hat{j}$

a.) $\vec{E} = \sqrt{E_x^2 + E_y^2} = \sqrt{2^2 + 3^2} = 3.6$ } Find the magnitude of $\vec{E}$, $\vec{F}$

$\vec{F} = \sqrt{F_x^2 + F_y^2} = \sqrt{2^2 + 2^2} = 2.8$

b.) Find $\vec{E} + \vec{F}$.

$\sqrt{(2+2)\hat{i} + (3-2)\hat{j}} = \sqrt{(4^2) + (1)^2} = 4.1$

c.) Find $-\vec{E} - 2F$

$-(2i + 3j) - 2(2i - 2j)$

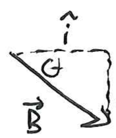
Grouping $\hat{i}$'s $\quad -2i \; -4i = -6i$

Grouping $\hat{j}$'s $\quad -3j + 4j = 1j$

So $\sqrt{(-6)^2 + (1)^2} = 6.1$

Problem 33)

$$\vec{A} = (5.0\,m)\,\hat{i}$$




$$\vec{B} = (3.0\,m\cos 45^\circ)\,\hat{i} - (3.0\,m \sin 45)\,\hat{j}$$

$3.0\,m\cos 45^\circ \rightarrow 2.12$ $\quad$ $3.0\,m\sin 45 \rightarrow -2.12$

$$\vec{C} = (-1.0\,m)\,\hat{k}$$

$$r = \vec{A} + \vec{B} + \vec{C}$$

$$r = (5.0\,m + 2.12\,m)\,\hat{i} + (-2.12\,m)\,\hat{j} + (-1.0\,m)\,\hat{k}$$

Pythagorean Theorem in 3-D!!

$$r = \sqrt{(7.12)^2 + (2.12)^2 + (1.0)^2} = 7.5 \text{ meters of displacement.}$$

You could also get angles below horizontal and south of east by looking @ any 2 dimensions at a time.